Sleep Health and Safety

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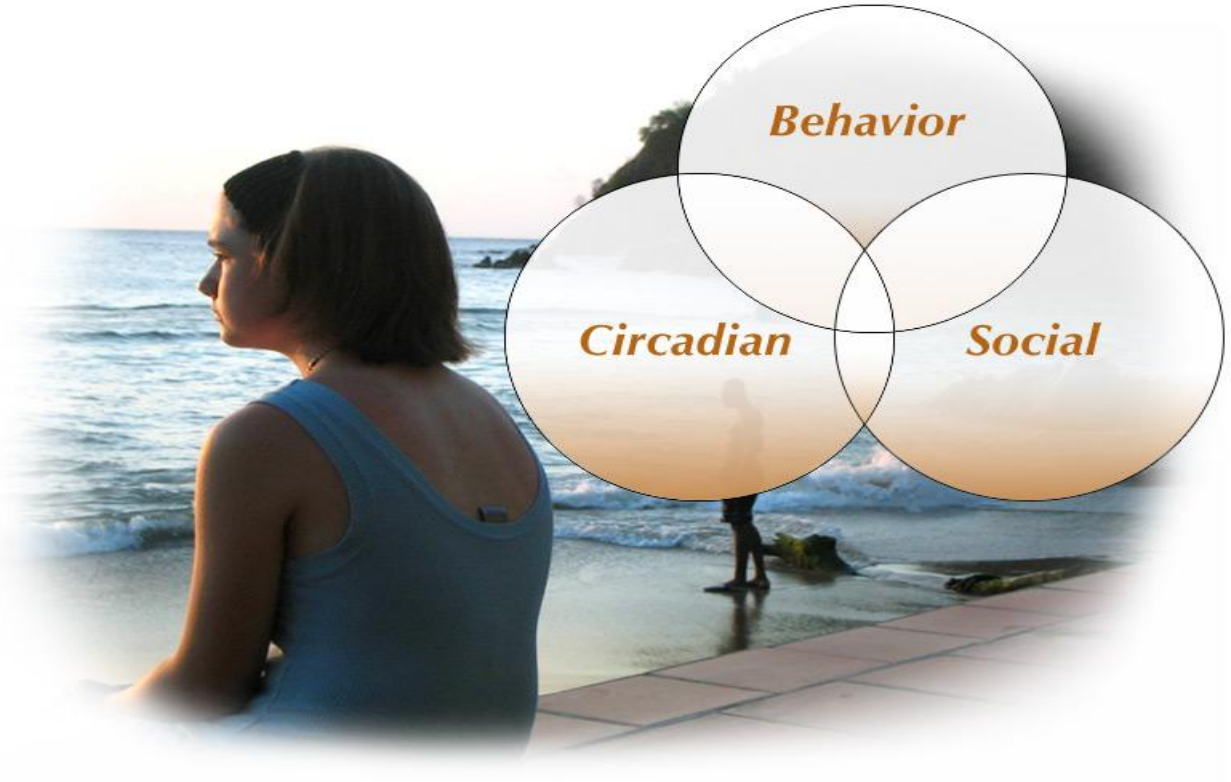
A Time of Transition

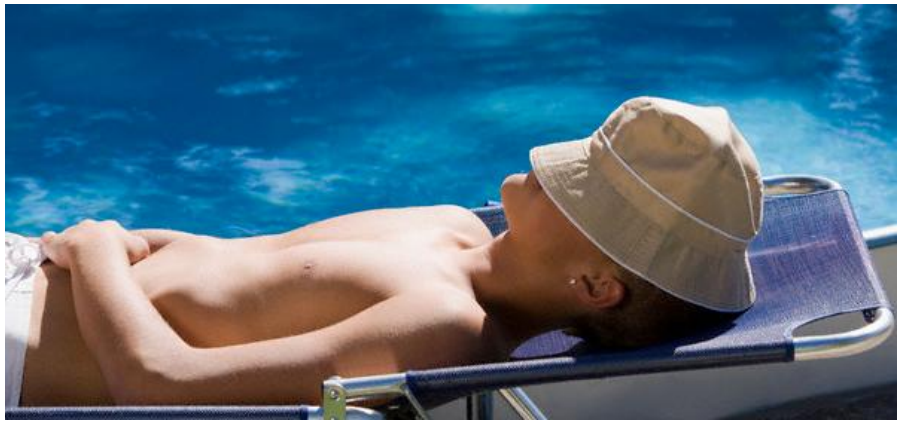


Adolescent Sleep

- Sleep Need
  - Recommended range: 8.5-9.5 hours
  - Avg. need 9.25 hours

Adolescent Sleep

- Relevant Developmental Issues
  - Circadian factors – approximate 2 hour phase delay
    - Melatonin secretion delayed (Carkskadon et al., 1998)
  - Weekend / weekday bedtime discrepancy
  - Increase in Excessive Daytime Sleepiness independent of insufficient sleep (Carksadon et al., 1993)



Adolescent “Sleep in America”

Daytime Sleepiness

- 51% reported feeling too tired during the day
  - More pronounced in high-schoolers (59%) than in middle-schoolers (41%)
- 19% fall asleep in school one day per week
- 11% reported arriving late or missing school because they had overslept at least one day in the past two weeks

Consequences of Sleep Deprivation in Adolescents

- Driving accidents
- Emotional and behavioral difficulties (both internalizing and externalizing)
- Health complaints
- Increased tobacco and alcohol usage
- Impaired learning
- Impaired decision-making
- Lower overall performance (from academics to sports)

National Sleep Foundation, 2009

Role of Caffeine

- [redacted] 70-98% of adolescents consume at least 1 beverage daily; 31% report 2+ per day (NSF 2006); most frequent time for soda-drinkers is 5-9pm
- Elimination half-life six hours
- Night waking
- decreases sleep time
- negatively impacts sleep quality

Nonprescribed Stimulant Use

- Review of 21 studies, n=113,104 (Wilens et al. 2008)
- Prevalence
  - high school 5-9%
  - College 5-35%
  - Predicators: Caucasian, Fraternity/Sororities, lower GPAs
- 16-29% of students with prescriptions were asked to give, sell, or trade their medications
- Most common reasons included reduce fatigue, improve concentration

Role of Electronics

- Typical Day: 12 hour screen media; 25% of this time due to media multitasking (Rideout et al. 2010)
  - Increase of over 2 hours per day in past five years
- Cell phone use: Of those with cell phones, 7-12th graders text 1.5 hours/day; talk 36 min/day (Rideout et al. 2010)
- Cell phone use after 9pm: 34-50% of high-schoolers text (Calamaro et al., 2009)

Drowsy Driving

- Drowsiness or fatigue principle cause in at least 100,000 police-reported traffic crashes each year, killing <1,500 Americans and injuring 71,000 (NHTSA, 1994)
- Young drivers age 25 or under involved in more than half of fall-asleep crashes.
- 51% of adolescents report they have driven drowsy at least once in the past year; 5% have fallen asleep while driving at least once (NSF, 2006)
- Peak age for fall-asleep driving is 20 (Pack et al. 95)
- Interactions between crashes and insufficient sleep include drunk-driving and driver lapses / inattention

What is Fatigue?

Sleep Debt

- Describes the cumulative affect of sleep deprivation
- It needs to be repaid like financial debt
- Not easy to make up

Symptoms of Fatigue

- Eyes closing or going out of focus
- Eyes start to burn
- Wandering or disconnected thoughts
- Adjusted radio more than once in last hour
- Forget to turn off signal from lane change
- Need stimulants to stay alert
- Unaware of passing vehicles
- Not able to remember last warning sign
- Irritable, exhausted, and giddiness

Impact of Sustained Wakefulness

17 Hours = .05% Blood Alcohol

KENTUCKY DRIVING UNDER THE INFLUENCE:
.08% Blood Alcohol

24 Hours = .10% Blood Alcohol

Dawson and Reid. **Center for Sleep Research - University of Australia** 1997

What a Difference an Hour Makes

Time Change and
Effects on Vehicle Crashes

Spring: 1 hour less of sleep, crashes increased more than 7%

Fall: 1 hour more of sleep, crashes decreased more than 7%

NOTE: There are also more reported crashes in the fall due to more hours of darkness.

Sleep Restrictions Profoundly Reduces Performance

(University of Pennsylvania with 35 healthy adults)

Results:

UNCONTROLLED SLEEP ATTACKS	THINKING ABILITY ALERTNESS & TASK PERFORMANCE
4 hours sleep : 50%	Marked Decrease
6 hours sleep: 25%	Moderate Decrease
8 hours sleep: 0%	Improved.

Conclusion: Poor Sleep can impair safety within one week.

Source: National Sleep Foundation Publication, summer 1999

Impact of Sleep Debt on Appetite
2 days of 4 hrs/day

- Hormone that decreases appetite (leptin) ↓ 18%
- Hormone that increases appetite (ghrelin) ↑ 28%
- Hunger ↑ 24%
- Appetite ↑ 23%

Spiegel et all, Ann Intern Med 141:846, 2004

Drowsy Driving Technologies

- Rumble strips
  - Reduce off-road crashes by 30-70%
- Warning System in vehicles
  - Uses video camera to track vehicle position in lane & generates warning for unsignaled lane changes or vehicles drifting out of their lane
- Driver fatigue monitoring in vehicles
  - Cameras using infrared retinal reflectance detect slow eyelid closures

Effects of Fatigue

- Slowed reaction time
- Reduced accuracy
- Diminished ability to see subtle changes
- Lapse of attention
- Compromised problem solving and decision making
- Poor communication skills
- Short-term memory lapses
- Reduced motivation
- Irritability or hostility
- Empathetic
- Intrusion of sleep into wakefulness
- Decreased energy
- Decreased learning of new tasks
- Reduced hand-eye coordination

Consequences of Driving Sleep Deprived

- Have slowed reaction times
- Exhibit erratic driving habits
  - Tailgating
  - Drifted onto the shoulder or off the road
  - Braking for no apparent reason
- Become more accident prone
- Operate on automatic pilot
- Cannot remember the last few miles driven
  - Do not remember exits or landmarks you have passed

Falling Asleep at the Wheel

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State Drowsy Driving Information in Drivers Manual

	Number of States
Yes	43
No	8

Recognizing Fall-Asleep Crashes

- Typically single vehicle roadway departure
- Not speeding
- No evidence of braking
- Low alcohol
  - Low level alcohol and sleep loss interact

Training for Police Regarding Drowsy Driving

	Number of States
Yes	19
No	32

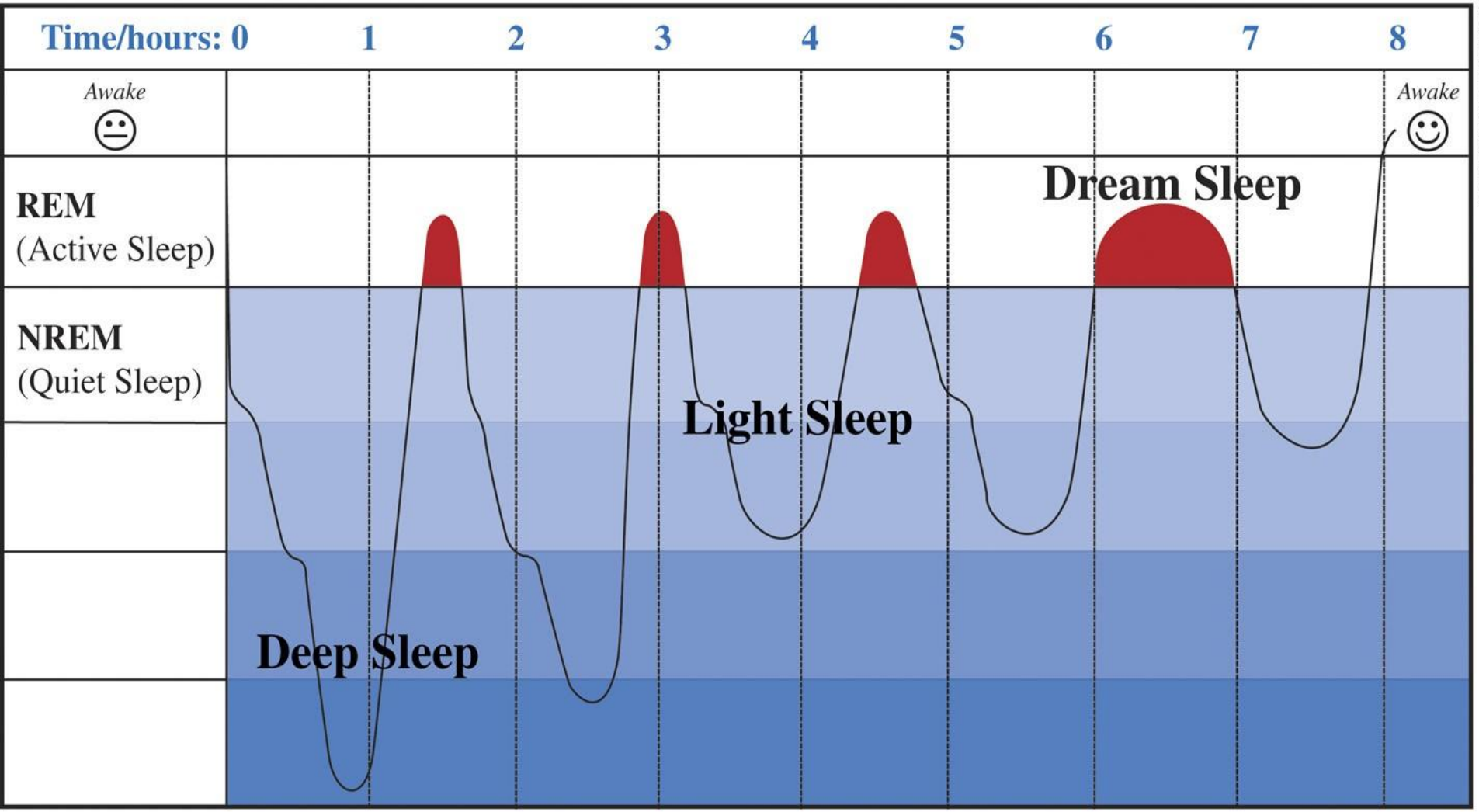
Case Study

- **"Now when I see a truck in a ditch, I think I know how and why it happened!"**
  - **Walter Johnson, *Dart Transit***
- ***A driver who just logged 8 hrs of sleep is pulling over for naps every 2 hours. He is worried about nodding off while driving. He is tired all the time and worn out day after day. His sleep is often disrupted by variations in his driving schedule.***

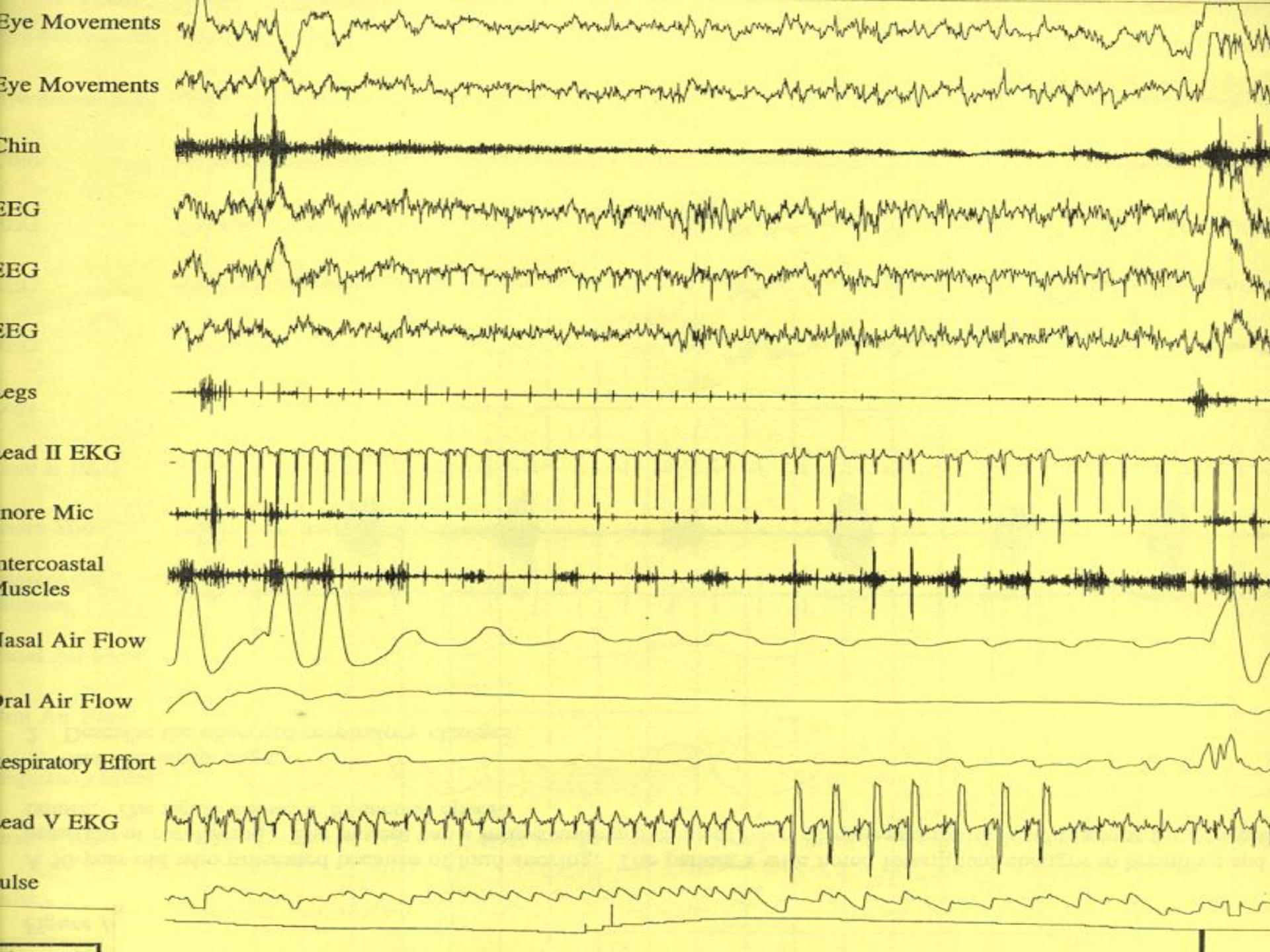
When questioned about his sleep……

- He is a loud, habitual snorer
- He feels tired and groggy on awakening
- He falls asleep easily during waking hours
- He is overweight and has a large neck
  - BMI >30
- Has been observed to choke, gasp, and hold his breath during sleep
- Has elevated sugar levels and blood pressure

The Normal Sleep Process



Quanta Dynamics, Inc.
THE SLEEP EDUCATION COMPANY


Eye Movements
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Chin
EEG
EEG
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Legs
Lead II EKG
Snore Mic
Intercoastal Muscles
Nasal Air Flow
Oral Air Flow
Respiratory Effort
Lead V EKG
Pulse

Why address sleep apnea?
It is a safety risk

- 25% report falling asleep at wheel last year
- > 6 times increased risk for crash
- > 7 times increased risk for multiple crashes

HIGH RISK CITIZENS (DRIVERS)
326% More Health Care Dollars Spent Each Year

Medical Claims with Citizens at Risk = $3,803

- Smokers
- High Cholesterol
- High Blood Pressure
- High Stress
- No Exercise
- Poor Diet

Medical Claims for Citizens Not at Risk: $1,166

Additional Annual Claims Paid When at Risk:

$2,637

(Yearly Savings per Driver)

Schneider National Trucking

- 547 drivers tested for a sleep disorder between April – December 2006
- 445 – 80% - were positive for a sleep disorder
- Healthcare costs reduced by 50%
- 73 % reduction in preventable driving accidents among a group of 225 SDB-diagnosed drivers
- Driver retention increased 2.29 times
  - Compared to 2005
  - Provided CPAP treatment free

Definition of High-Risk Driver

- A recent fall-asleep crash
- Repeated near-miss fall asleep episodes
- Repeated falling asleep in other active situation (during conversation; at meal time)
- Very high score on Epworth Sleepines Scale (very high not defined - >15 pr >16)
- High risk driver – stop driving until treated

Recommendations to defend against fatigue

- Education
- Scheduling drive time: bright light to remain alert
- Planned naps
- Routine rest and meal breaks
- Light therapy
- Use Evidence to drive safety practices
  - What actions drive change to improve the safety

Before “hitting the road”

1. Get adequate sleep—most adults need 7-9 hours to maintain proper alertness during the day
2. Schedule proper breaks—about every 100 miles or 2 hours during long trips
3. Arrange for a travel companion—someone to talk with and share the driving
4. Avoid alcohol and sedating medications—check your labels or ask your doctor

Countermeasures to Prevent a Fall-Asleep Crash While Driving

- Watch for the warning signs of fatigue
- Stop driving—pull off at the next exit, rest area or find a place to sleep for the night
- Take a nap—find a safe place to take a 15 to 20-minute nap
- Consume caffeine—the equivalent of 2 cups of coffee can increase alertness for several hours
- Try consuming caffeine before taking a short nap to get the benefits of both

Tips for Better Sleep

- **Exercise regularly and do it at least 3 hours before bedtime**
- **Eat regular, nutritious meals, but not a heavy meal near bedtime**
- **Have a routine for going to bed and rising each day**
- **Create a positive sleep environment**
- **Assess effect of tobacco, caffeine and alcohol**

Caffeine -- does it help?

- Caffeine promotes short-term alertness.
- Takes about 30 minutes to begin working
- Better:
  - pull over for a caffeinated beverage,
  - take a short nap, and
  - then get back on the road.
- Caffeine won't have much of an effect on people who consume it regularly.

Vehicle Warning Detection Devices

- Mercedes
  - Device to detect wandering into another lane and traveling too close to another vehicle
- Volvo
  - Device to detect wandering into another lane
- Trucks
  - Device to detect eye closure

Conclusion

- Importance of recognizing sleep deprivation as a risk factor for safety
- Identifying the impact of sleep loss
- Recognition of untreated sleep apnea as a risk factor for safe driving

Questions

- For information contact
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